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CENTRAL INTELLIGENCE AGENCY

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SOURCE:

Photo Accession No.:

946766 Hsiao-shan 30 10N 120 16E
Hsiao-shan Electrical Machinery Plant, Chekiang. Photo shows electric motors produced for use in rural areas. The plant was built in 1958. It manufactures hydraulic turbines and generators in addition to electric motors.

1070635 Hsi-an 34 17N 108 58E
First 500,000v standard condenser in China being tested at the Hsi-an Electrical Condenser Plant. Equipment is used to conduct scientific research and measure ultra high-tension electric equipment, current transformers, electric cables, etc. 1965.

1082429 Shen-yang Transformer Plant 41 49N 123 22E
[ ] Final test of 220kv cable-

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EXPEDITE

Photo Accession No.:

condenser-type, meter current transformer before shipping. First trial produced in 1964. It is used to protect relays and to gauge electric current and power. 1965.

1082430 Shen-yang High Voltage Switch Plant
41 48N 123 26E [redacted] 25X1
New compressed air circuit breaker being tested. 1965.

1082434 50,000kw duplex, internal water-cooled, steam turbo-generator manufactured by the Shang-hai Electrical Machinery Plant. First of its kind in the world using the direct water-cooling stator and rotor coils. It has twice the capacity of air-cooled generators of same size. 1965.

1082435 Shang-hai Electric Machine Plant, Min-hang.
31 00N 121 25E [redacted] This is 25X
the largest all-inclusive electrical machinery plant in China. It designs and manufactures various generators and motors for use in rural areas. Photo shows upright electric motors being readied for shipment. 1965.

1082436 Hsi-an Heavy Electric Equipment Plant
34 16N 109 02E [redacted] 25X
220kv condenser-type meter transformer being assembled. Trial model produced in 1964. It is used for measuring and protecting high-tension lines. Transformer formerly imported from foreign countries. 1965.

1082437 Ta-lien Electric Machinery Plant 38 54N
121 35E [redacted] Electric motors 25X
on assembly line. 1965.

1082438 Pao-ting 38 52N 115 29E
Pao-ting Transformer Plant storage room showing transformer awaiting shipment. 1965.

943990, 1000922 Shang-hai Diesel Engine Plant 31 19N 121 32E
[redacted] Conveyor system for engine 25X
blocks.

1102385 Shang-hai Steam Turbine Plant, Min-hang
31 00N 121 24E [redacted] 25X
6,000kw gas turbine being tested. This turbine becomes a generating set when combined with generator and does not require a large boiler. Crude oil, filtered fuel oil or natural gas can be used as fuel for this turbine. It is suitable for mobile power plants in oil producing areas. Trial model manufactured in 1965.

1102391 Wu-hsi Diesel Engine Plant 31 34N 120 19E
[redacted] Low oil consumption diesel 25X
engines being readied for shipment. Can be used in farm drainage, irrigation, processing farm products and for transportation. Engines favorably received at Leipzig and Luzerne Trade Fairs.

10045-150

Photo Accession No.:

1065350, 1154544 — Che-chi Hydroelectric Station 28 41N 96 55E
(General views of dam)

1154542, 1154543 — Hsin-an-chiang HE Plant, Tung-kuan
29 29N 119 13E [redacted] 25X
Transmission tower and transformer station.

Enclosure: As stated above

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CHINA'S ELECTRIC POWER INDUSTRY SUPPORTS INDUSTRIAL AND AGRICULTURAL PRODUCTION THROUGH INCREASED PRODUCTION AND ECONOMIZATION

STAT

Large-scale Increase in Power Generating Facilities in 1965

The electric power industry in China has recently shown rapid development, and it is meeting the development of industrial production and the demand for rural electrification. The electric power situation during this process is reported as follows by the dispatches of the New China News Agency.

In China in 1965 power generating facilities which surpass the grand total of those in 1963 and 1964 were put into production.

New transmission lines were stretched to main grain- and cotton-producing areas, and the consumption of electric power in these areas was increased by 29% over the preceding year.

At present, in most villages in over half of the 2,12[illegible] being throughout the nation, electricity is being utilized for irrigation, drainage, processing of agricultural products, and illumination of the houses of rural families, schools, people's commune offices, and clubs.

The consumption of electric power in the rural areas in 1965 had increased by 25 times compared with that in 1957 -- the year preceding the establishment of the people's communes.

China's electric power industry fulfilled in advance the annual target for 1965. Great results were achieved in 1965 regarding safe production and supply of electric power.

In thermo-electric power stations a total of 1.6 tons

of fuel was saved, and in the process of electric power supply, 490 million kWH of electric power were economized.

A dispatch of the Chung-kuo Hsin-wen She (China News Service) dated 2 May 1966 reports as follows on the situation of electric power in the rural areas.

Since the formation of the people's communes in 1958, the electrification of rural areas had seen great progress in broad rural villages of China, especially in the suburbs of cities and the main food and cotton production centers. At present the capacity of electric motors for farmland irrigation has increased 45 times compared with that in 1957, and the consumption of electric power in the rural areas has increased 34 times. Electricity has been spread to over 1,300 hsien throughout the nation. The progress made in rural electrification in the Pearl River Delta, the Yangtze River Delta, the North China Plain, the Sung-liao Plain, the Kuan-chung Plain, and the middle and lower reaches of the Yangtze and Yellow Rivers is of considerable scale. In such national minority areas as Kwangsi, Inner Mongolia, and Sinkiang the use of electric power in rural areas is making constant progress. In the Tibet Autonomous Region situated in the Southeastern Plateau of China, over 30 medium and small power generating stations have been constructed in the past several years. In remote mountainous areas where no electricity was used, electric lights now glitter like so many stars.

Construction of Power Stations in Several Places

The construction of power stations of late is as follows: The Number 2 generator (75,800 KW) at the Che-hsi Hydroelectric Power Station began its generation in 1965, and the Number 3 generator is ready to be installed. Similarly, the Number 3 generator at the Hsi-ta-yang Hydroelectric Power Station (2,000 kW) in Hopei Province started its generation on 10 January 1965. The installation of the Number 5 generator (72,500 KW) at the Hsin-an-chiang Hydroelectric Power Station (650,000 KW) was completed, and its Number 6 generator is being presently installed. The Number 1 generator (generating power unknown) at Nan-ch'ung-ch'ing-chu -- the first generating station on the Chia-ling River in Szechwan Province -- has begun operation. The following is news pertaining to small power stations in various places.

Kwangtung Province -- In T'ai-shan Hsien, construction of the Overseas Chinese Hydroelectric Power Station (invested in by overseas Chinese) at Ta-lung-tung (over 2,000 KW) the total over 20 km of high-voltage transmission lines formal operation began on 18 November Service, 22 November 1965.)

In Ta-pu Hsien, the Pai-hou Hydroelectric Power Sta

(2,080 KW) is under construction. Four sets of generator units will be installed here.

In the rural areas of the Li and Miao Autonomous Chou in Hainan over fifty small hydroelectric power stations (including hydraulic turbines capable of generation) have begun operation. In the same autonomous chou are 23 hydroelectric power stations and a group of hydraulic turbine pumping stations capable of power generation. (New China News Agency, 3 July 1966.)

Yunnan Province -- The western part of the province has water resources amounting to five million KW. At present there are over 80 small power stations scattered throughout villages in the hills. These power facilities total 30 times more than those of the Liberation period, and their generating capacities are more than 50 times as great. The length of their transmission lines is 3,400 Km. In 1965 plans to construct over 70 power plants with over 1,500 KW capacity were formulated. Already the construction of 26 plants with almost 700 KW total capacity has been undertaken. (China News Service, 11 October 1965.)

In Yu-hsi Hsien the construction of 63 small power plants with a total capacity of 1,800 KW has been completed, and 17 additional power plants are under construction. (NCNA, 2 July 1966.)

Nanpai Chuang Autonomous Chou -- Here power generation for 15 days is equivalent to that for one year before the Liberation. The capacity of power plants has been increased over 20 times compared with the early post-Liberation period. In addition to large and medium power plants, a group of small hydroelectric power stations have been constructed. (CKS, 10 October 1965.)

In the Ta-miao and Chan-miao Autonomous Hsien many people's communes constructed a group of small hydroelectric power stations in 1965. (CKS, 1 February 1966.)

Yunnan Province -- There was only a small power plant of 240 KW capacity in Ta-li Hsien before the Liberation, but now a hydroelectric power plant has been constructed at Hsi-erh-hai. Thus the supply of electric power has been greatly improved. (Chung-kuo Hsin-wen [China News], 5 February 1966.)

In the Hsi-shuang-pan-na Thai Autonomous Chou seven small-scale power stations have now been completed and there are six others now in construction.

In the Thai farming villages in Lu-hsi Hsien of the Te-hung Tai Chingpo Autonomous Chou are found 23 small hydroelectric power plants, and 4,000 farming families are using electric power.

Inner Mongolia Autonomous Region -- In this autonomous region over 300 medium and small power plants have been completed. Thus the electric generation capacity has been increased by six times compared to that in 1955. Before the

Liberation there were only small power plants at Urumchi, Aqsu, and Tahcheng. But considerably large power plants have already been constructed at over ten cities including Urumchi, Wu-la-ma-i, Shih-ho-tse, Kashgar, and in the factory and mining districts. Moreover, small thermo-electric and hydroelectric power plants are under construction in scores of hsien scattered both north and south of the Tien-shan Mountains, at over 100 State-operated farms, livestock farms, and at some people's communes. (NCNA, 22 September 1965.)

Tibet -- There are over 40 medium and small power plants. In the latter half of 1965, six small hydroelectric power stations were completed, and the plans call for the construction of 12 power plants. The generating power of each of these ranges usually from 10 KW to several tens of KW, and they are under construction through the investment by the sectors related to the Central Government.

Kirin Province -- The largest and 27th hydroelectric power station of the province was completed and began operation in the latter part of March 1965 (400 KW); it is situated along the Huang-shui River. (NCNA, 2 April 1965.)

The Capacities of the Completed Large Power Plants

Through these news reports we can judge that numerous small power plants have been constructed in the rural areas throughout the nation. As to large power plants, the Number 2 generator (57,500 KW) at the Hsi-chin Power Plant seems to have begun operation. And it is about time for the 44,000 KW generator to be used at the Yen-kuo-hsia Power Plant (400,000 KW) on the Yellow River to begin operation. In 1965, hydroelectric power generating facilities amounting to over 100,000 KW were completed in Harbin, and because hydroelectric generating facilities are naturally combined with the designing of dams, it is consequently imagined that a large power station has been completed on the Yellow River system in order to install these facilities.

As to thermal power generation, China has succeeded in the trial manufacture of a 100,000 KW double internal water-cooled steam turbine generator. It is reported that this Chinese-developed generator, which directly cools the stator and rotor with water, can boost generation capacity to twice as much as the air-cooled type. And because the 50,000 KW generator unit has now been mass produced for several years, there should be no technical problems in mass producing 50,000 and 100,000 KW generators.

As to power transmission, transformers as large as 120,000 KVA and 220,000 volts have been manufactured at Harbin. Large transformers with capacities of 240,000 KVA have recently been manufactured. The advanced air-filled

type 220,000 KVA high-voltage circuit breaker is being produced at the Mukden High-Voltage Switch Plant. They have also succeeded in the trial manufacture of the 12-ton class high intensity suspension type insulator that can be used for 330,000-volt super high-voltage transmission lines. As to electrical condensors, the new type of condenser using trichlorobenzene as insulation infusion material has come into being. Even though actual figures for recent years have not been published at all, we would not be surprised to find that the capacity of the new power generating facilities surpasses that of the total of 1963 and 1964.

Rationalization of the Management of Modern Large Power Plants

On one hand, technology has been improved in the generating, transmitting, and distributing sectors of China's power industry, and management has been rationalized. On the positive side, the latent potentials of facilities have been dug up, and a great amount of electric power is being produced. For instance, at the conference of the directors of the hydroelectric sector of the nation in 1965, it was recommended that the experience in the reform of enterprise management carried out at the Peking Thermoelectric Plant -- which is one of the main power plants in the Peking-Tangshan-Taiwan electrical power network -- be disseminated to modern large power plants throughout the nation. Its contents consisted of: (1) Administrative structures were simplified; the nine sections of the entire power plant were reorganized into five control teams; control was concentrated in the higher section, and service was carried out by the service sub-teams. (2) Branches were abolished, and the production of the entire power plant was organized into the two large systems of "power generation operation" and "facilities maintenance." Under the unified guidance of the chief and assistant engineers, specialized fuel, boiler, and generator technicians were assigned. Thus the specialized control of facilities and operation was strengthened, allowing for the solution of important problems and insuring safe and economical operation. (3) The ranks of repair workers were concentrated, and by consolidating more than 400 inspector-repair personnel, repair team under the guidance of a higher firm was organized. This repair team was assigned repair work not only for this power plant but also for five other power plants in the electric power network, thus saving manpower at the other power plants. (4) The range of responsibility of each engineering workshop was re-defined. Thus the limits of too detailed division of work were broken up and the method of letting one section taking care of other sections was adopted. (5) After the

reform of the organizational structure, the regulation system concerning finance and material supply was correspondingly improved, and the delivery of materials to work sites was carried out.

Through the foregoing reforms, the total number of workers at the power plant was decreased from 1,500 to 760. Even if the repair team was included, the total number was decreased by one-third. Yet breakdowns were repaired in less time than before, and interruptions and accidents were decreased. And the time needed for boiler ignition, the starting of the generator, and for increased transmission and connection was shortened.

The Foreign-type System was Fully Reformed

To elaborate this, the Peking Thermoelectric Plant began its operation in 1959. At that time there were comparatively few such large thermoelectric power plants throughout the country. Thus the workers lacked management experience and they had to borrow the enterprise management methods of a certain foreign country. These management methods played a certain role in safe operation. But many irrationalities were found in practice. Electric power generation is extremely complicated, and the relationship among the fuel, boiler, generator, thermal control meter, electricity, and chemical processing sectors is extremely close. The past management methods did not start from the characteristics of production, but instead from the emphasis on "specialized control." Thus one unified production process was divided into six workshops, and each workshop was equipped with a certain level of personnel and facilities. Moreover, too many sections were established in one part of the power plant, which resulted in mutual restraint. Thus the regulating system was unfavorable to production. Consequently, the organizational structure as well as personnel organization became huge. Moreover, the division of work among sectors was too detailed. The system was too complicated, and mutual accomodation was bad. This resulted in many obstacles and problems not being solved in time, and many persons being engaged in wasteful labor. Because this power plant is a component part of the Peking-Tientsin-Tangshan-Kalgan electric power network, certain specialized work of the plant had to be controlled uniformly by the control structure of the electric power network -- the Peking Electric Power Company. But the power plant was operated as a completely independent production unit, and each specialized sector had its own organization. Therefore, large amounts of manpower and materials were wasted.

The Old Generating Facilities were Revived by Technical Reform

At old power plants technical reform has been carried out to remodel old facilities and to improve the generating capacity and efficiency. The Liao-yuan Power Plant in Kirin Province, which was established in 1921, remodeled their old 1930 facilities into comparatively better facilities among the power plants of a similar category, and it thus became an advanced power plant. It is now lauded as the "Ta-ch'ing of the electric power sector." At this plant 700-800 grams of coal were used for each KWH. But in the last decade, the workers at the same power plant carried out over 200 comparatively large technical reforms. The capacity of the old facilities surpassed the level of design, and the facilities were brought up to the most advanced level among power plants of a similar type throughout the nation. The amount of coal consumption dropped to the lowest among plants of a similar type throughout the nation. The amount of coal saved at the power plant during the past 16 years has totaled almost 1 million tons. The coal unloading, coal transportation, coal ash elimination operations of the power plant have almost been completely mechanized.

One boiler at the Hsia-kuan Power Plant in Nanking had some defects and did not fully exert its capacity, thus adversely affecting the plant's power generating capacity. The plant remodeled this boiler in the latter half of 1964, and added appropriate supplementary machine facilities in order to combine the generating power of the main and supplementary machines. Consequently, the power generating capacity of this plant was increased in 1965 by 10,000 over 1964.

The rated output of the Number 1 generator at the Soochow Power Plant is 3,600 K. But when the temperature of river water rose in summer, cooling became a problem and output dropped to 3,000 K. This year the workers at the plant overcame the difficulty of material shortage and added a condenser to the generator in order to expand the cooling area, thus allowing the generator to finally produce its rated output.

200 Million KWH was Saved in the Power Distribution Sector in 1965

In the power generation and distribution sectors of Shanghai Municipality, electric power was utilized by such methods as load adjustment, and the consumption of electric power at the plant was economized. At the same time, transmission losses in various fields were reduced. The total

amount of electric power used at the plant and the total amount of power saved through the elimination of transmission losses by the electric power system in Shanghai during the period from January-September in 1965 was over 28 million KWH.

In the electric power sector in Kiangsu Province the consumption of electric power at the main plants in such cities as Nanking, Chin-chiang, Shang-chou, Wusih, and Soochow was clearly defined. By adjusting operation, service, and the hours of electric power use, a large amount of electric power was turned over to rural areas. The problem of limited transmission capacity due to irregularity in the specifications of leading wires in certain sections of the high-voltage transmission lines was solved. Larger amounts of electric power were poured into transmission lines in excess of the safety coefficient established by the "regulations" of a certain foreign country, and the transferring of part of Shanghai's electric power to rural areas was successfully carried out.

The workers in the electric power sector in Manchuria have achieved safe electrical supply, strengthened line maintenance and safe operational control of the electric power network, contributing to the economization of electricity. As a result of the strengthening of line maintenance in 1965, transmission loss was reduced by 0.36% over the preceding year. This alone saved 27.66 million KWH.

Each power plant in Shantung Province strove to economize electricity. At the Huang-tai Thermal Power Plant it was discovered that the consumption of electric power by the small facilities at the plant for one month amounted to over 500,000 KWH. Thereupon in 1965 these small facilities were reorganized, classified, and measures were taken to reduce the consumption of electric power for miscellaneous uses. Consequently, over 3.89 million KWH were saved during the period from January to September.

Electric power saved in the process of supplying power during 1965 throughout the country amounted to 490 million KWH.

While Thermal Efficiency was Increased Coal Consumption was Reduced

As was mentioned earlier, the thermal power plants throughout the nation saved a gross total of 1.6 million tons of fuel during 1965. The coal consumption for power generation during 1965 was reduced by 2% compared with 1964. The thermal efficiency of boilers has approached or reached international advanced levels.

In this year also production at power plants across the country has been better than ever before, and the consumption of coal and electric power at plants has been drastically reduced. If we combine these together, it is estimated that over 300,000 tons of coal were saved during the period from January to May 1966. In addition, various power plants used inferior coal to save over one million tons of good quality coal for the country, turning it over to steel and chemical fertilizer industries. This year the workers at many power plants challenged various obsolete rules and conservative modes of thinking which hindered increased production and economization, and at the same time they adopted practical organizations and technical measures.

At the Fu-hsin Power Plant, generated power reached only 90% of full capacity because there were problems in the manufacturing and designing of three sets of imported machines. Some workers thought it would be extremely difficult to improve the power generating capability of the facilities beyond the present level. But during this year's movement for increased production and economization the workers corrected their wrong thinking, consolidated their basic training for operation, examined rules in detail, and found key points. They repeated their research, made bolt tests, adopted several effective measures, took out two useless valves from each set of machinery, raised steam pressure and steam temperature to the specifications, and raised the generating power of the facilities to the designed capacity. Through only this one reform, more than 10,000 tons of coal were saved for the year. Coupled with other measures, the coal consumption at the Fu-hsin Power Plant during the first quarter of 1966 was reduced to 321 grams per KWH, which is a new record.

At the Yang-shu-p'u Power Plant in Shanghai many workers used to be bound by foreign ways and old habits. They figured that they had to supply water with three sets of feed pumps to the high-voltage boiler, otherwise it would affect safe operation. But this year the workers boldly proposed to remove one set of feed pumps, and carried out repeated tests with the support of the factory leadership. As a result, it was proved that two sets of pumps would completely satisfy the high-voltage boiler. This measure resulted in the economization of facilities as well as the economization of over 10,000 KWH per day.

This year the workers at the Huai-nan Power Plant destroyed bourgeois "authorities," obsolete rules, and old systems to attain great production. The power generation during June was increased by 7.5% over the average during the period from January to May, and by 6% over the corresponding period of 1965; that during July was increased by 8.2%. In August, power generation was increased by 2.18 million KWH, and during

this month the highest record of power generation per day was achieved. At the same time the power consumed at the plant was markedly reduced compared with that during the corresponding period of 1965. The coal consumption rate at the plant reached the advanced level stipulated by the State, and the cost of power generation was drastically reduced. At the same time, the same plant is executing the plan for safe power generation.

The Electrification Method that Economizes Several Hundred Million KWH

Not long ago the Ministry of Water Conservancy and Hydroelectric Power held a national on-the-spot model operation conference on electrification work at Anshan Municipality in Liaoning Province. At this conference the great results of electrification work which had been well disseminated during the past year were fully examined, and experiences pertaining to this were exchanged.

Electrification work methods call for carrying out inspection and repair of high-voltage lines and facilities. If this were to be practiced throughout the country, at least several hundred million additional KWH of electric power could be supplied, and with this much power over ten million tons of chemical fertilizers or steel could be produced.

Electrification work was initiated in foreign countries in the 1930's, but only a few nations have adopted it. In China it was first tested and studied in Manchuria in 1953. In 1957 a series of insulating equipment for electrification of power transmission lines was made. In 1958 the workers of the Anshan Electric Bureau succeeded in testing them on lines of comparatively low voltage. Thereafter the Technical Improvement Bureau of the Northeast Electric Power Management Bureau succeed in testing the equipotential method of power transmission on super high-voltage lines. At present electrification work has been spread to 27 provinces, municipalities, and regions throughout the nation. The number of types of work covered by this has been increased from ten to 160, and the range of voltage is from 10,000 V, 35,000 V, 110,000 V, and 220,000 V. Electrification work can be carried out anywhere, including plateaus, rivers, mountains, the extremely hot south, and the extremely cold north. The tools for electrification work are small and light-weight, and can be tied together so that they can be carried in a knapsack. Many aspects of electrification work have reached the world's most advanced level or surpassed it. Some of them are not known in other countries.

Electrification work is greatly advanced in China, but further expanding types and range of electrification. In some areas electrification work is added to the

regular inspection and repair methods. If this is carried out, there will be no interruption of current and the needs of industrial and agricultural production will be filled. Some units, after having executed electrification work throughout the entire electric supply system, are making studies to change the partially electrified work in the transformation and distribution systems to entirely electrified work. Electrification work is also being studied for the power generating system. If tests are successful, it would have a great impact on the socialist construction of China.

China entered her Third Five-Year Plan this year, and she is promoting socialist construction amid the great proletarian cultural revolution. The National Holiday is close at hand, and many reports of increased production at many plants are coming in, which gives rise to a very bright outlook. The electric power industry which supports this industrial production will be assigned a greater duty in the future, but this year it will show a development surpassing that of 1965.

Photo Captions:

1. At the Hsin-an-chiang Hydroelectric Power Plant (650,000 KW), which was designed and constructed for the first time by China alone, generators 1-4 (72,500 KW each) began operation in 1964. Thus the consumption of electric power in the rural areas of Chekiang Province was increased over 100 times compared with 1957.

2. This is a demonstration of electrification work by the workers of the electric power management sector at the Hsin-an-chiang Hydroelectric Power Plant in Chekiang Province in east China. Electrification work which does not interrupt current and enables the inspection and repair of transmission lines is helpful to the support of industrial and agricultural production, and it saves a large amount of State funds.

3. The number 2 generator (75,000 KW) at the Che-hsi Hydroelectric Power Plant in Hunan Province began generating in 1965. This plant was designed, constructed, and equipped by Chinese capability alone. Its total output is over 400,000 KW, and it transmits electricity to neighboring industrial regions and rural areas in the Tung-t'ing Lake area.

4. A panoramic view of the Che-hsi Hydroelectric Power Plant in Hunan Province. Its construction was begun in July 1958. Power generation capacity of its facilities is 435,000 KW.

and its annual average generation reaches 2.35 billion KWH. As of the summer of 1965, Numbers 1 and 2 generators were in operation. (illegible)

5. In the suburbs of Shanghai Municipality transmission lines are being rapidly expanded, and the area of electric irrigation is being markedly increased. The photo shows workers of the Shanghai Electrical Supply Bureau working on super high-voltage transmission lines. (illegible)

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ACCOMPLISHMENTS OF CHINA'S POWER MACHINERY INDUSTRY

[redacted]

In China, since 1960, the Ta-ching oil field has been exploited and the epoch-making economic change has occurred that self-supply of oil has become possible, and it seems that with this, production of diesel engines and other power machines which use oil and oil gas as fuel has suddenly begun to advance. That result has been plainly shown in such news as successful trial-manufacture of a 6,000-kilowatt gas turbine and successful trial-manufacture of an 8,820-horsepower marine diesel engine.

6,000-Kilowatt Gas Turbine

According to a New China News Agency Shanghai dispatch of 1 December, China's first gas turbine was successfully trial-manufactured recently at the Shanghai Steam Turbine Plant.

The structure of the entire gas turbine unit is well-arranged, it is centrally controlled by gauges, operation is convenient, and all economic and technical characteristics are at a quite advanced level. This gas turbine consists of three main parts - air compressor, combustion chamber, and turbine, - and with the generator and other accessory equipment, it forms one generator. As the result of continuous operational generation for a quite long period of time, it has been shown that when the unit is set in operation, the generator reaches rated output in a comparatively short period of time, sending out a great amount of electric power, and that its efficiency is good. The State Inspection Committee formed by the No. 1 Machine Industry Department, Water Utilization and Electric Power Department, and related units of Shanghai, affirmed after inspection that this unit's efficiency is good, its operation equable, its starting quick, and that it conforms to design requirements.

This gas turbine uses heavy oil or filtered fuel oil as fuel, and can use natural gas if slightly altered. This unit has no large-volume boiler as well as its accessory equipment and pipes, and a boiler room and coal yard are also unnecessary. Also, the volume of the entire unit is small and its weight light, and compared with a steam turbine powerplant of the same capacity, in construction, metal material, the powerplant building, and investment in equipment can all be reduced by about one half. Also, since this equipment has both automatic and manual control and automatic safety equipment, operational and maintenance personnel are greatly reduced.

This unit can be used in construction of movable powerplants, and since it is especially suitable for use in oil-producing areas of little water or coal, at the present time in which China's oil industry is advancing, production of this gas turbine is considered to have great significance in development of the Chinese economy. Also, since this gas turbine can generate its full load in a comparatively short period of time after being set in operation, large-sized powerplants of industrial cities can regulate loads at the proper time by setting the gas turbine in operation at times of peak electrical consumption.

Gas turbine power equipment is something new which has a history of only a little more than 20 years in the world. In China, in 1964, the Nanking Turbine Plant built China's first gas turbine for industrial use, and the capacity of this first equipment was 1,500 kilowatts. The fact that about one year after that a 6,000-kilowatt gas turbine was successfully trial-manufactured shows China's speedy technical development in this field.

In the course of trial-manufacture of the 6,000-kilowatt gas turbine, workers and technicians of the Shanghai Turbine Plant received strong assistance of more than 40 related units including the Railroad Electrical Industry Bureau of the Water Utilization and Electric Power Department, Huatung Electric Power Design Academy, Shanghai Electric Machinery Plant, and Chinghua University, and many new processing methods, new techniques, and new materials were made and used. Domestically-made materials were completely used in the construction of equipment, and it is said that even though rotors and blades which were made using domestically-produced steel material are operated at high temperatures of from 600 degrees to 700 degrees centigrade and at very low temperatures of several tens of degrees below zero, good mechanical efficiency can be maintained.

8,820-Horsepower Marine Diesel Engine

Another 1965 accomplishment of China's power machinery which should be mentioned is the successful trial-manufacture of China's first 8,820-horsepower heavy-model low-speed diesel engine at the Shanghai Hutung Shipbuilding Plant. As a result of this diesel engine's having been installed in 10,000-ton-class large-model vessels and having conducted sea navigation, it can be said to have been demonstrated that its efficiency is good, and since during the past few years in China, although construction of large-sized ships and production tech-

niques of hull construction have advanced, in marine machinery it has not been possible to produce diesel engines and they have had to be imported from foreign countries or substitute steam engines, successful trial-manufacture of this large-model marine diesel engine holds epoch-making significance for China's shipbuilding industry.

According to an 18 November dispatch of the New China News Agency, at the time workers of the Hutung Shipbuilding Plant began trial-manufacture of this machine, there was no existing technical data to refer to and also there were no machines or large factory buildings for processing large-model items. Because of that, some persons held doubts that it was possibly too soon to now construct such a large diesel engine, and some persons advocated that technical data be brought in from foreign countries. At this time, a certain capitalist firm member came on a visit for business talks and gave the terms that the price for plans was several hundreds of thousands of dollars and that subsequently, as China produced each engine, four percent of the price would be paid, and even if none should be produced, several tens of thousands of dollars would be paid each year. Workers and technicians of the shipbuilding plant, hearing of these severe terms, are said to have bestirred themselves to try to contruct this large-model diesel engine by their own efforts.

Before setting about manufacture of the entire machine and with the objective of gaining experience, they first built a single-cylinder experimental machine. In this construction process many experiments were advanced and much data came to them, and from this, basic data was obtained. It is said that many experiments failed, but they were started again several times, and with repeated experiments, the various parts were improved each time.

In the process of construction, the method of the three consolidations of management, workers, and technicians was adopted at this shipyard, and many combined native and foreign machine tools were newly made, and equipment necessary for processing large-model parts of a weight of more than 50 tons was manufactured by their own effort.. At the same time, technical innovations and technical revolutions reaching several thousand items were realized in the entire plant, and not only were construction problems of the large-model diesel engine solved, but production efficiency was increased and technical experience was gained.

Also, in construction of this diesel engine, the plant, university, and research institute joined together, and the three items of design, construction, and use, were unitedly advanced. Such units as Shanghai Chiaotung University, Ship Design Academy, Hsinhua Power Machinery Plant, Shanghai Ship Plant, and the Hutung Shipbuilding Plant jointly formed design groups and conducted on-the-spot designing. More than 200 units of the entire country also provided special materials for construction of this important product, solved experimental and research problems, and accomplished processing tasks.

A 2,200-horsepower marine diesel engine was also manufactured in Shanghai last year. In order to limit weight to nine tons, the latest techniques of welded steel plate structure and supercharging were combined.

New-Type Combustion Chamber Designed in Tientsin

According to a 24 October New China News Agency dispatch, a new type of high-efficiency combustion chamber, which is the most important part of a diesel engine, was designed at the Tientsin Internal Combustion Research Institute, and it is considered that this new accomplishment will make a great contribution to further development of China's internal combustion engine industry.

This internal combustion chamber is called a "compound type" and has "air injection" and "solid injection." This is the direct result of diligent research continued for the past several years by the Tientsin Internal Combustion Research Institute concerning increase of combustion efficiency. According to results of experiments, this type of 10-horsepower diesel engine can put out 13 to 14 horsepower of power, and fuel consumption is lower than other types of diesel engines which China has produced previously.

In this "compound type" combustion chamber, part of the fuel is consumed by "air injection" and part is consumed by "solid injection," and the proportion can be adjusted. Since the good points of both the old fuel jet method and the new jet method have been adopted and combined, starting of this new engine is easy, it does not give off noise or smoke, and its vibration is at a minimum. Various fuels such as diesel oil, petroleum, and kerosene can be used.

Recent Situation of Diesel Engine Plants

The above are China's latest accomplishments in advanced, large-model power machine production, and in addition to this, production of small-model power machines for the purpose of advancing water drainage and irrigation in agricultural villages, agricultural machines, and mechanization of processing of agricultural products, can be said to have truly been advanced with great horsepower. In internal combustion engines, aside from coal gas engines, diesel engines, and gasoline engines, such things as free-piston gas diesel engines and exhaust intensified diesel engines have been produced. According to a 12 October 1964 dispatch of the Chungkuo Hsinwen, it is said that in power for agricultural use, several tens of kinds of power machines were produced in 1964, and that if production capacity is calculated in horsepower, it has increased to more than six times that of the First Five-Year Plan (1953-1957).

Below, we will briefly list the present status of principal diesel engine manufacturing plants as recently reported.

Shanghai Diesel Engine Plant

In less than two years after 1958, more than 600 pieces of specialized equipment were manufactured and 7 automatic and semiautomatic production lines were constructed. Also, the model 135 Tung-fang-pei diesel engine which is of Chinese design and was successfully produced by technical efforts within the plant is of excellent quality

and all of its materials are domestically produced. In 1965, duction task of the model 135 Tung-feng-pei diesel engine, plant's principal product was increased 33 percent from year and fuel nozzles were increased 39 percent, and [illegible] of realizing this production task, 1,272 technical [illegible] realized in the first quarter of the year alone, and every production plan was exceeded. Also, the plant is being [illegible] in the 1 April 1965 issue of Jenmin Jihpao, an article by [illegible] who is the responsible designer of the No. 2 Design Section [illegible] 1 Machine Industry Department which designed the expansion [illegible] plant, was published, and according to that it was estimated [illegible] expansion design assignment that investment would be 39,000,000 [illegible] (2,850,000,000 yuan), but as a result of the design it came to [illegible] 35,350,000 yuan. However, there was waste in that design, and [illegible] result of checking and revision, it is said that 14,020,000 yuan [illegible] investment was saved.

Wuhan Power Machinery Plant

Diesel engines previously used in China have been of the water-cooled type, but this plant successfully trial-manufactured an air-cooled-type diesel engine designed by China's own efforts (New China News [illegible], September 1965). This 20-horsepower air-cooled diesel engine passed a 1,500-hour endurance test, and it was affirmed to be far superior to the same kind of water-cooled diesel engine model, and the weight and the amount of copper used are less than the water-cooled type.

[illegible] Diesel Engine Plant

[illegible] is one of five quite large-scale plants in Wuhan which manufacture electric motors, diesel engines, and gas engines of more than [illegible] horsepower. Since manufacturing its very first engine in 1[illegible]7, [illegible] has supplied 50 percent of the diesel engines used in [illegible] Province, and its 1965 production exceeded 2[illegible],000 [illegible].

[illegible] Engine Plant

[illegible] years ago this plant could only do "rough work" such as cotton [illegible]. [illegible] 1965 it began production of diesel engines in[illegible] and [illegible] "industrial-agricultural model 7" hand tractors. [illegible] of making diesel engines for four years, [illegible] of the plant was comparatively weak and it did [illegible] precision engine tools necessary for manufacturing [illegible]. To this record, workers were given technical in[illegible], a technical innovation movement was ex[illegible], [illegible] of equipment by their own efforts was undertaken, [illegible] four months, blueprints were drawn up for more [illegible] tools necessary for production of diesel

engines, and high-precision, high-efficiency facilities including [illegible] things as diamond boring machines, revolving-table milling machines, and fluid-pressure profile lathes were designed and trial-manufactured, and it became possible to produce diesel engines, and it is said that about one out of two of the machine tools used in the plant's production are either made by the workers or rebuilt by them, and they have won repute in the Wuhan machine industry community.

Dairen Diesel Engine Plant

The 2-10 model 20-horsepower marine diesel engine is [illegible] produced and supplied to fishermen. This special-design diesel [illegible] after being used experimentally for one year by fishermen of the [illegible] districts of Chou-shan and Lu-ta, formally entered production. The [illegible] size of the engine is small, its weight light, and starting and [illegible] are comparatively easy, and at the same time, vibration is [illegible] is economized, and it is suitable for powering small-model [illegible] When this diesel engine and related equipment are installed [illegible] vessels of 15-ton carrying capacity going out fishing in moderate [illegible] weather, seven to eight nautial miles per hour can be traveled, and even when fully loaded, they can travel four to five nautical miles per hour. When a starting electric motor is attached to the [illegible] engine, fast starting is assured even in times of emergency or [illegible] ing rainstorms and at temperatures of less than 10 degrees centigrade. When a pulley and small-sized generator are attached to the [illegible] engine, the net-winder can be operated with the generated electricity, and at night it can be used for illumination.

Kiangsu Province Changchou Diesel Engine Plant

The model 105B diesel engine is produced, and aside from [illegible] used for powering hand tractors (power of "industrial-agricultural [illegible] 7" is model 195), it is mostly used for powering drainage and irrigation of farm villages and processing of agricultural by-products. In the month of last year, after receiving a letter from a certain commune in Kuangsu-chien in Kiangsu Province saying that the cone rod of the model [illegible] diesel engine made by the plant had broken and could not be used, an overall examination of the quality of the product was made and [illegible] processing methods changed, and by the end of July more than 600 [illegible] nical innovations were made, and the qualifying rate of the July [illegible] engines was raised to 98.9 percent from 90.5 percent at the end of the previous year, and the qualifying rate of principal parts was increased to 99.9 percent from 94 percent at the beginning of 1965.

Shanghai Chengfu Power Machine Plant

[illegible]-1" diesel engine is produced, and coming to [illegible] in this engine, they recently designed by their own efforts the "model 195-2" diesel engine which is suited to the needs of China's rural villages and is also economical and rational. This

diesel engine, as compared with the old product, has from two to six more horsepower, its weight is 40 kilograms less, and its structure is simple.

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RECENT BRISK ACTIVITY OF THE CHINESE ELECTRICAL MACHINERY INDUSTRY WHICH IS DEVELOPING BOTH VANGUARD AND ORDINARY PRODUCTS

Level Greatly Raised Since the Liberation

Genuine development of the Chinese electrical machinery industry has occurred since the time of the first five-year plan. Prior to that there were about 30 electrical machinery enterprises but they could only produce ordinary generators, electric motors, and transformers. During the first five-year plan large-sized electrical machinery plants, steam turbine plants, boiler plants, high-tension switch and rectifier plants, high-tension insulator plants, electricity condenser plants, insulating material plants, electric meter plants, carbon brush plants, and other modern enterprises were built throughout the country, being provided in battle formation. With the 16 years of construction since the birth of the new China, China's electrical machinery industry has accomplished great transfiguration and it has completely extricated itself from the previous backward situation in which the kinds and standards of products of the electrical machinery industry were few, products did not have unit quality, and the majority of raw materials depended on imports from foreign countries. At present, self-supply has become possible for all electrical machinery and equipment considered necessary in various branches [illegible] machinery and the greater part of a number of high-grade, [illegible] electrical machinery products. The kinds of products of the electrical machinery industry have more than doubled since 1957 and the quality of products has also advanced remarkably.

In electrical machinery and appliances, quantity production of 5,000-kilowatt thermal electric generator units as well as 72,500-

kilowatt hydroelectric generator units and 5,000-horsepower marine turbines for use in ocean navigation have been manufactured, and it has become possible to produce in quantity transmission and transformer electrical equipment of 220 kilovolts and below. In addition, an electronic static electricity accelerator of several million e v used in atomic energy research and as a source of radiation has been manufactured, and production is being started.

Aside from the new series of products which has greatly developed in medium and small-sized electrical machinery and low-tension electrical appliances, several thousands of altered form products suitable for various climatic, environmental, and use conditions have been born. In addition, electrical equipment has been manufactured which is combined with important products such as automatic argon arc welding machines, shock-wave spot welding machines, and other kinds of new-type welding equipment, vacuum induced electricity furnaces, vacuum self-consumption electric furnaces, hydrogen gas carbon pipe annealing furnaces, 25,000-ton synthetic ammonia equipment, 1,513 m^3 blast furnaces, 1,150 mm lump rolling machines, 4 m^3 excavating machines, 5 m hoists, and mining machinery.

In electric meters, precision meters such as 0.2-class precision meters, 0.02-class precision meters, and 0.1-class medium-frequency experimental equipment are generally combined with general-use electrical machinery products in the country and satisfy requirements for conducting general measurement experiments. In electrical machinery materials, silicon insulating paints, glass-fiber reinforced epoxy resin insulated products, ferromagnetic permanent magnets, precision electric resistance wires, alloy switch points, and many other new-type insulation materials as well as electrical machinery alloy materials are being manufactured, and generally satisfy production demands for electrical machinery products.

Compound Inner Water-Cooled Steam Turbine Generator Unprecedented In the World

In the overall orderly development of all branches of the national economy, the electrical machinery industry is also steadily growing at present. This trend appears in the previously-related large-sized, precision, newly-produced, complicated, high-grade products which are being produced one after the other as well as in the development of production quantity and quality of distributed and practical-use products seen in the increased production of electrical machinery for farm villages. From ultramodern to ordinary items, they are generally trying to quickly catch up to the world level, and among them, some have already surpassed it. For example, the compound inner water-cooled steam turbine generator which directly cools coils of stators and rotors with water has not yet been successful even in the world.

The compound inner water-cooled steam turbine generator is at present the most advanced of the various steam turbine generators. In a generator, coils are wound in the rotors and stators, and when electricity is generated, the leading wire heats up from the great electrical

current. Since the insulation material of the coils can for a long period of time usually withstand a temperature of up to 130 degrees centigrade, when the temperature becomes too high, they burn up. Consequently, this becomes a factor limiting the generator's capacity, and conditions for increasing the capacity of the generator become making the coils with insulating material which withstands high temperatures so that greater electrical current can flow through, improving the cooling method, and making heat radiation of the coils good.

There are inner and outer cooling methods. Outer cooling is also called indirect cooling, and since it cools from the outer surface of the coil insulation layer, the heat radiation effectiveness is not very good. Later, inner cooling was adopted in which the coil leading wire is staggered or it is made with an empty center and the coil is cooled with the wind applied directly to the copper wire. This is much better than outer cooling, and at first the gas used for cooling was air, but later, hydrogen was adopted. Fluid cooling has also been developed for about 10 years, and this uses oil or water instead of gas in cooling. Of air, hydrogen, oil, and water, water has the greatest cooling capability, and if the cooling capability of air is made 1, hydrogen is 12 to 15 and water is 50. The first successful use of inner water cooling in the world was in 1956, and that was with only the stator. Inner cooling of rotors has been discussed in international literature, but since solution of some of the technical problems is difficult, as of now no country has been successful in it except China.

Grappling With World Advanced Technology With Four Years of Experience

In 1958, when the second five-year plan began, it was planned at the Shanghai Electrical Machinery Plant which makes steam turbine generators to within two years trial-manufacture a stator inner water-cooled and a rotor inner hydrogen-cooled type steam turbine generator, catching up with the world top level. At that time, not a few people thought that since China had only a four-year history of manufacturing steam turbine generators and foreign countries had finally arrived at this level after 60 to 70 years, the speed would be considerable if this plan were realized. However, throughout the country the situation of the national economic Great Leap Forward soon appeared, and in it, Chekiang University, in cooperation with the Chekiang Hsiaoshan Electrical Machinery Plant began experimentation on a small-sized generator with rotor inner water cooling and manufactured one small-sized compound inner water-cooled steam turbine generator. Employees of the Shanghai Electrical Machinery Plant also did not wish to follow behind foreign countries. Therefore, they changed their plans and set about design and trial-manufacture of a compound inner water-cooled steam turbine generator and succeeded in making one of 12,000 kilowatts.

After succeeding in trial-manufacture of the first compound inner water-cooled steam turbine generator, employees of the Shanghai Electrical Machinery Plant continued a great amount of experimentation and accumulated definite technological experience. In 1960 they also

Some Other New Electrical Machinery Products

Success in manufacture of this compound inner water-cooled steam turbine generator was first announced this year, and it is said that it has already had normal operation for nearly 300,000 hours in 17 powerplants and that the amount of electricity produced has reached more than 3,000,000,000 kilowatt hours. Consequently, it can be said that the fact that its efficiency is excellent has been adequately tested.

In addition, there are the following new electrical machinery products which have been manufactured this year.

100,000-Kilowatt Hydroelectric Generator

The Hsinanchiang Hydroelectric Powerplant no. 4 generator (72,500 kilowatts), the Hsichin no. 1 generator (57,500 kilowatts), and the Shechi no. 2 generator (75,800 kilowatts), have begun generating power, and it has been known that this class could be produced in quantity, but at the beginning of this year it was reported that 100,000-kilowatt hydroelectric generating equipment had been completed at Harbin. The rotor of the water-power turbine is cast from alloy steel, and the principal axis which connects this to the generator is made of 60 tons of forged alloy steel. However, it is not known in what powerplant this generator is being used.

1,500-Kilowatt and 6,000-Kilowatt Gas Turbine Generators

China's first 1,500-kilowatt gas turbine generator unit has been trial-manufactured at the Nanking Turbine Plant since last year. This unit consists of a turbine, gas compressor, combustion chamber, and other accessory equipment, and as a result of trial operation it has been demonstrated that the starting is fast, revolution smooth, it easily withstands change of load, and that it completely meets design requirements. Either light oil, heavy oil, natural gas, or oil gas can be used as fuel. This was made by the same plant in cooperation with the Steam Turbine and Power Research Institute of the No. 1 Machine Industry Department.

Recently, China's first 6,000-kilowatt gas turbine was successfully manufactured at the Shanghai Turbine Plant. The Shanghai Turbine Plant has in recent years manufactured several tens of kinds of steam turbines of various models and outputs, and this 6,000-kilowatt gas turbine which was successfully trial-manufactured was manufactured in a comparatively short time with their own materials. The excellence of its efficiency has been demonstrated by 72 hours of continuous full-load operation. The main body of the gas turbine has a floor space of only about 30 square meters, and it was designed for use as a train powerplant. The gas turbine has the merits of light weight, small volume, and fast starting, and in comparing ordinary gas turbine powerplants with steam turbine powerplants of the same output, the building is small, and the amount of metal material used and basic investment are about half. Operating personnel of the powerplant are also from about one-third to

one-fourth the number. Gas turbines of large output are power machinery which has also recently developed internationally, and successful manufacture of this 6,000-kilowatt gas turbine shows that China's turbine-manufacturing technology has considerably advanced. Recently, by means of exploitation of the Taching oil field, China's oil resources have become very abundant, and it may be noted from that point of view that gas turbines have been trial-manufactured one after the other.

1,000-Kilowatt Back Pressure Turbine

The Hangchou Turbine Machinery Plant has begun small-scale production of a 1,000-kilowatt back pressure steam turbine which can be automatically regulated and which it successfully trial-manufactured. This is China's first, and its sensitivity to automatic control is keen. Regulation of the electric power load can be done by remote control, and together with the boiler and generator it can be used as a private powerplant by medium and small-sized light industry enterprises and chemical industry enterprises, and is economical. It was successfully trial-manufactured by the same plant in cooperation with the Steam Turbine Research Institute of the No. 1 Machine Industry Department.

High-Precision Variable Frequency Power Source

China's first high-precision variable frequency power source was successfully manufactured in Shanghai. This can continuously change frequency, one serving the function of several generators. Moreover, electricity generated from this has high frequency stability, strain is very slight, and as compared with ordinary generators it is suitable for efficiency measurement of precision electrical machinery and electric meters. The Shanghai Measuring Standards Control Bureau and specialists of related plants approved the design and manufacture of this power source, and it has been recognized that its precision is at the internationally advanced level, and moreover, its volume is small, structure simple, and cost low.

120,000-KVA Transformer; Movable Large-Sized Transformer

The Shenyang Transformer Plant, China's largest, has manufactured a new 120,000-kva, 220-kilovolt, 3-phase large-sized transformer for generating facilities. Advanced technology has been used in its cooling equipment, insulation material, and oil tanks. Also, the same plant manufactured China's first 15,000-kva, 110-kilovolt movable large-sized transformer, and delivered it to the railroad branch. Stationary transformers of the same capacity which are presently manufactured in China exceed the height and width limits of steel and girder bridges, and when they are forwarded from the plant, it has been necessary to dismantle them for transport and then reassemble them. The new transformer can be loaded in a specially-made freight car and transported anywhere that railroads go and be quickly used. In addition to its small volume, its resistance to earthquakes is good, and its use and

maintenance are convenient. This was trial-manufactured in response to China's railroad construction needs.

Air Circuit Breaker

The Sian Switch and Rectifier Plant successfully trial-manufactured a 220-kilovolt compressed air circuit breaker of its own design, using domestically-produced materials. Its weight is 11.5 tons, and breaking of the electric current, arc extinction, and circuit reopening, are done in less than one second. Also, at the Shenyang High-Tension Switch Plant, a new type of full air-charging type air circuit breaker for use with 110-kilovolt high-tension transmission lines was successfully trial-manufactured. Ones which have been used in China until now are generally oil circuit breakers, but the action of the air circuit breaker is fast and its capacity is large. When trouble occurs, the power source is automatically cut off within 0.7 second and reconnected within 0.25 second. Oil circuit breakers require 0.9 second in cutting off and connecting. Also, the capacity of the circuit breaker is one-seventh greater than an oil circuit breaker, and consequently, its protection range is much greater. Also, 18 tons of transformer oil can be conserved with one air circuit breaker.

Large-Capacity Silicon Rectifier

The Peking Transformer Plant, in cooperation with the Construction Research Institute of the Metallurgical Industry Department, has manufactured a large-capacity silicon rectifier element and all equipment. This was completed with an investment of only about 100,000 yuan and in about six months. Prior to this, the same plant has manufactured three sets of large-capacity silicon rectifier equipment which have been delivered to and used by metallurgical and transportation branches, and their operational status is good. One of those, the silicon rectifier equipment used for trolleybusses of the Peking Streetcar Company, is of 600V and 1,000A, and its efficiency is four percent higher than a mercury rectifier of the same capacity, and every year about 40,000 KWH of direct current electric energy is conserved, which corresponds to 4,000 yuan (600,000 yen). The degree of automation of the rectifier is also comparatively high, and when trouble occurs, it can automatically charge over to a reserve circuit, operating continuously, and even at -50 to -40 degrees centigrade, it functions normally.

The above-related new products were developed as the result of an expanded movement of compare, learn, overtake, and assist, with the three consolidations of workers, technicians, and management, and this has played a great role not only in vanguard products but also in increasing production and raising quality of ordinary products. Especially, the recently-developing product design revolution has produced an independent product system which is technologically advanced, economically [illegible] and which moreover conforms to China's actual situation.

[illegible], the Shanghai 51 Electrial Machinery Plant

has conducted three revolutions in design of electric motors. Production of alternating-current electric motors at this plant developed suddenly several years ago, but compared with advanced products within and without the country, they still had the defects that production efficiency was relatively low, weight great, and cost relatively high. For the purpose of changing this backward situation, the 51 Electrical Machinery Plant in 1960 conducted its first product revolution. Reforming the backward aspect of their own product as constrasted with the product of the internationally advanced level, they succeeded for the first time in China in improvement of the JO2-type electric motor. The total weight of the product after reform was reduced by more than 80 kilograms, and the gap with the internationally advanced level was reduced. With this success, employees of the 51 Electrical Machinery Plant thought this was adequate, and during the next four years did not greatly improve the product, and indeed the level of capacity and weight fell behind the international index. Moreover, since during this time, the international level of electrical machines also newly developed, production of the 51 Electrical Machinery Plant fell further and further behind. Taking a certain model number of a four-polar electrical machine as an example, the product of the 51 Electrical Machinery Plant had a capacity of only 17 kilowatts, but the international advanced level had already reached 22 kilowatts, and the 22-kilowatt electric motor of the 51 Electrical Machinery Plant was 40 kilograms heavier than the internationally advanced product. Users were very dissatisfied concerning the fact that the product of the 51 Electrical Machinery Plant continued to remain at the level of the 1950s. Thereupon, in 1964 they conducted the second product revolution. Increasing from the previous 17 kilowatts to 22 kilowatts the capacity of the four-polar electric motor with a core height of 180 mm, and reducing the weight by 51 kilograms, the international advanced level was reached. This time, employees of the 51 Electrical Machinery Plant, not being satisfied with that result, and studying the report of Premier Chou En-lai to the Third People's Representatives Conference, noticed that the two design revolutions accomplished so far had stopped at only "catching up" to the international level, and that there had not been the great volition to "surpass" the international advanced level. Thereupon, this year they conducted the third design revolution. In [illegible] they succeeded in designing motors of still greater output and still less volume. In one of these, with a core height of 160 mm, the capacity was increased from 10 kilowatts to 17 kilowatts, and in another with a core height of 180 mm, the capacity was increased from 22 kilowatts to 30 kilowatts. Important technical characteristics of these products, such as weight and capacity, all surpass international advanced products of the same type.

Also, taking the Changchou Transformer Plant as an example, this plant, gathering together and applying last year's experience, continued to develop a movement of compare, learn, overtake, and assist, and it has also recently raised the quality of three kinds of transformers to the level of first-class products. Last year, the Changchou Transformer Plant investigated the points wherein in each of the four

quarters, parts and manufacturing processes were inferior as compared with the Shanghai Transformer Plant, at the same time periodically exchanging data with 12 transformer manufacturing plants throughout the country, making clear the objectives in each period of its own plant's products reaching the order occupied in the whole country of quality and cost by comparing, learning, overtaking, and assisting. As the result of one year's effort, they caught up with or surpassed the advanced level of Shanghai in more than 100 processes, remarkably increasing the quality of transformers and also reducing cost by nearly 10 percent. However, employees of the plant, never being satisfied with present accomplishments, and based on the experience of last year, organized a group of management, technicians, and workers at the beginning of February of this year, and with 50 key point problems sent them to the Hsiangt'an Electrical Machinery Plant and the Shanghai Transformer Plant, having them work on the spot and study advanced experiences. Herein, they not only learned that the total working time required in electric locomotives used by plants and mines and made by their own plant was more than twice that of the Hsiangt'an Electrical Machinery Plant, but discovered that 860 processes, excepting the one process of gear cutting, were inferior. Upon returning, the persons who had gone out to study discussed backward points of the various parts and processes, and made clear the objective to catch up. Since then, they have decided upon concrete steps for overcoming backwardness and are steadily advancing.

Strengthening of Agricultural Assistance and Scientific and Technical Research

Development of the electrical machinery industry has great significance for not only the various branches of industry, but also agriculture. Recently, Chinese agricultural electrification has quickly advanced, and from 1957 to the present, the capacity of electric motors used for agricultural irrigation increased 33 times, and the amount of electricity used by farm villages increased 25 times (80 percent of which is used in agricultural production) (Chungkuo Hsinwen, 25 September, an article by Chuan Tso-i, Head, Water Resources and Electric Power Department). For the electrical machinery industry which is "facing" the farm villages, similarly to other branches of industry, farm villages are a large market, and cannot be neglected. China's electrical machinery industry in addition to supplying a large amount of farm village hydroelectric generating equipment, transmission and transformer equipment, electric power irrigation equipment, and agricultural by-products processing equipment in support of agriculture, has also in recent years increased production of products urgently needed in agriculture, forestry, livestock raising, by-products, and the fish industry, such as electric-powered [illegible], electric-powered plows, electric saws, electric hair-clippers, milk separators, electric locomotives for forestry use, and [illegible]-powered equipment for fishing vessel use.

Also, for the purpose of strengthening agricultural assistance, [illegible] hydroelectric generating equipment manufacturing plants have

experimentally established service stations, providing technical service for farm village electrical equipment. Farmers are also delighted that many services are being provided in the fields of complete provision of equipment, installation, technical guidance in operation, technical training of supervisory personnel, and expansion of repair of existing equipment.

China's scientific research work in the electrical machinery industry is also advancing rapidly. In addition to the overall research institutes and laboratories established in such places as Peking, Shanghai, and Canton, research organs are being established within the various specialties. For the past several years, various research units, earnestly carrying out the policy in their scientific research of "facing industry and serving industry," have expedited development of production and technology. They have made a great contribution in such fields as electrical machinery cooling technology, high-tension technology, vacuum metallurgy technology, new welding techniques, products for damp and torrid regions, new types of electrical machinery materials, and new insulation materials. Along with development of scientific research, a research experimental base has also gradually been established, and a scientific research camp embracing a considerable number has arisen.

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